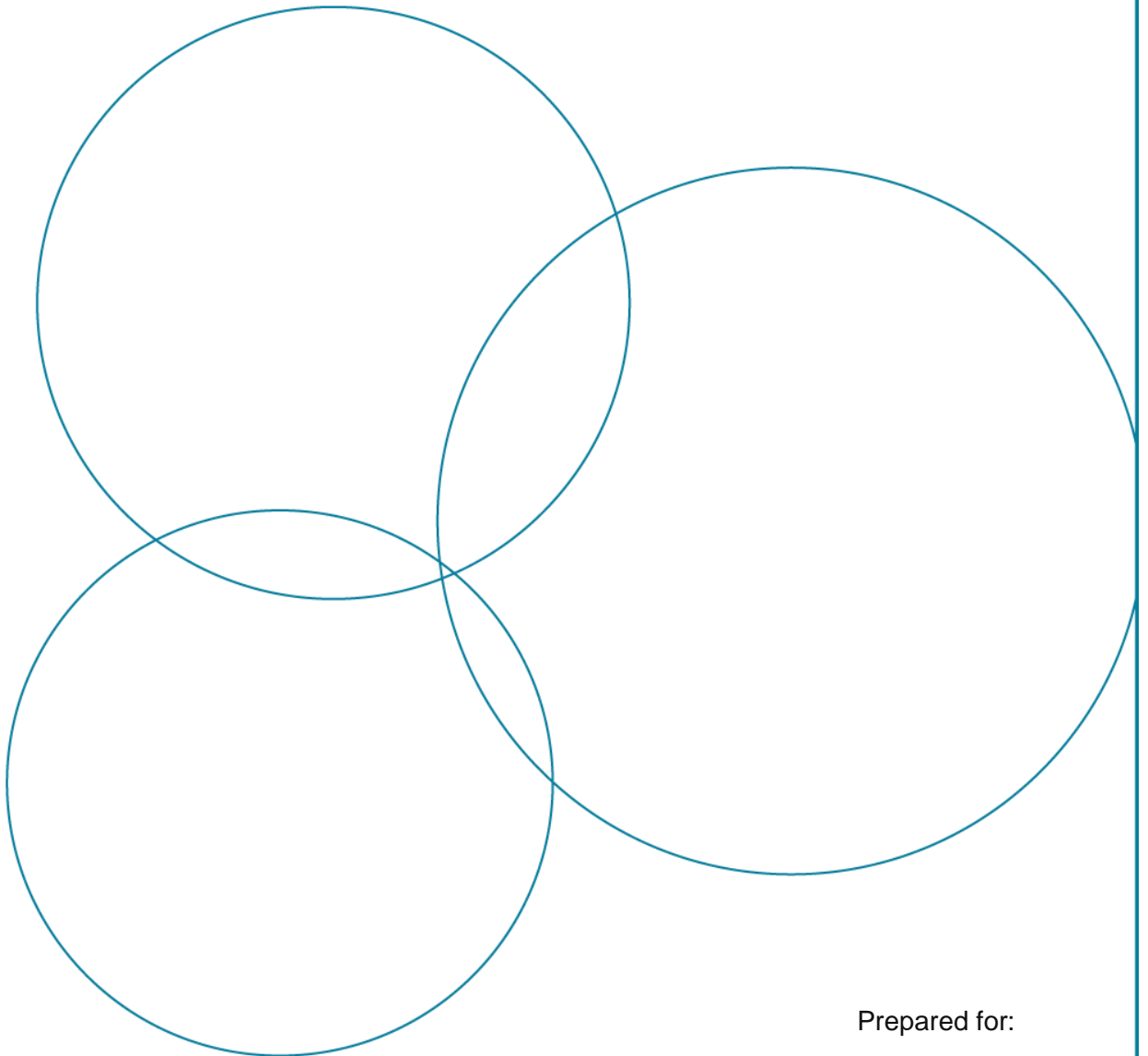


CUNDALL

5 August 2016

Sustainable Design Report Building Renewal Project



Prepared for:

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Revision	Description	Date	
-	First issue for Review	5/08/2016	
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<p>The success and realisation of the proposed initiatives will be dependent upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved.</p>			

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List of Abbreviations

ACM – Asbestos Containing Materials

ASI – Australian Steel Institute

BIM – Building Information modelling

BRSP – Building Renewal Sustainability Plan

CoS – City of Sydney

DA – Development Application

DCP – Development Control Plan

ECI – Early Contractor Involvement

EMP – Environmental Management Plan

ESD – Ecologically Sustainable Design

FSC – Forest Stewardship Council

GBCA – Green Building Council of Australia

GWP – Global Warming Potential

ISO – International Organisation for Standardisation

ODP – Ozone Depletion Potential

OEH – Office of Environment and Heritage

PVC – Polyvinyl Chloride

SOH – Sydney Opera House

SROI – Social Return on Investment

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1 Introduction

1.1 Purpose

This document is prepared to demonstrate compliance with the Development Control Plan (DCP)'s Ecologically Sustainable Design (ESD) objectives set out by the City of Sydney (CoS) for the Sydney Opera House (SOH) renewal project's Development Application (DA) submission.

This report provides a summary of sustainable design initiatives and the potential environmental effects of the project. The report is section as follows:

- Section 1 Introduction – provides project background and scope of works description.
- Section 2 Sustainable Design Strategy – provides detailed information on the project's sustainable design objectives, commitments and design initiatives to meet the ESD objectives.

1.2 Sydney Opera House Building Renewal Plan Background

In 2015 the Sydney Opera House began the Building Renewal Plan works to transform its visitors' experience, improve the arts spaces and upgrade the main infrastructure. The renewal plan includes twenty seven projects, six building studies and four visitor focused integration strategies. The Building Renewal Plan defined the concept, scope of works and priority of multiple projects during the next ten years. Projects are allocated over three phases of three years each.

Table 1 Sydney Opera House Building Renewal Plan

Building Renewal Plan Phases	Period	Building Renewal Plan Scope of Works Summary	Key Projects
Phase 1	2015-2017	Sixteen building projects; Two building studies; Four enabling projects.	Concert Hall Upgrade New Function Centre New Creative Learning Centre Upgrade Entry& Foyer Performing Arts Practice Support spaces
Phase 2	2018-2020	Nine building projects; One building study.	Visitor Welcome Centre Northern Multipurpose Space Drama Theatre Offices
Phase 3	2021-2023	Two building projects; Two building studies.	Studio Playhouse

The next section provides details of the scope of works for this DA submission which is part of the Phase 1 Building Renewal project.

1.3 Scope of Works

The scope of works for this DA submission is summarised below:

Table 2 Summary of Key Projects

Works Area	Summary of Key Projects	Leading Designer (if known)
Function centre	<ul style="list-style-type: none"> • New function centre. Require new interior finishes and services. • Remove existing marquee at the Northern Broadwalk. • Renew offices, kitchen and stores. • A temporary kitchen is required to maintain service to the Utzon Room and other venues whilst the new Function Centre is being built. 	Tonkin Zulaikha Greer Architects
New rehearsal room	Convert the existing secondary ballet rehearsal room to the new rehearsal room. Require new services and finishes.	Tonkin Zulaikha Greer Architects

2 Sustainable Design Strategy

2.1 Opera House Commitment and Design Objectives

The Opera House Environmental Sustainability Plan (ESP) 2017-2019 sets out ambitious targets by 2023. The plan provides an achievable roadmap towards the 2023 sustainability targets to embed environmental sustainability in twelve key focus areas: energy, water, materials and procurement, waste, climate change, transport, nature, people, risk management, stakeholder involvement, ecologically sustainable business practice(s), education and awareness for audience and visitors.

The key relevant targets are summarised below:

- 7% reduction in carbon footprint by 2019.
- 60% demolition waste reduction.
- 80% construction waste reduction.

To ensure the ambitious sustainability principles and targets associated with the Opera House ESP are included in every stage of the Opera House building regeneration project Cundall has been engaged to prepare a Building Renewal Sustainability Plan (BRSP).

2.2 Development Control Plan (DCP) ESD Objectives

The development is also designed in accordance with the following DCP ESD objectives:

- Apply principles and processes that contribute to ESD.
- Reduce the impacts from development on the environment.
- Reduce the use of resources by the development over its effective life.
- Reduce the cause and impacts of the urban heat island effect.
- Ensure that greenhouse gas emissions will be reduced.
- Increase the use of cogeneration and tri-generation systems.
- Replace intensive carbon power sources with low carbon and renewable energy.
- Reduce the use of potable water.
- Increase the resilience of development to the effects of climate change.
- Ensure that development can adapt to climate change.
- Ensure that waste will be reduced.
- Increase the use of products from recycled sources and waste recycling.
- Improve indoor environmental quality.
- Reduce the environmental impact from building materials through reduction, re-use and recycling of materials, resources and building components.
- Improve biodiversity.

The following sections provide details of the design initiatives which meet and/or exceed the DCP ESD objectives.

2.3 Key Sustainable Design Principles

The project has considered the following key sustainability principles throughout Concept and Schematic Design stage:

- Promote sustainability design.
- Minimise greenhouse gas emissions and provide low carbon energy sources.
- Improve outdoor and indoor environment quality.
- Reduce environmental impact by sourcing sustainable building materials.
- Reduce operational, construction and demolition waste from site.
- Reduce potable water consumption.
- Support health and wellbeing of staff and visitors.
- Considerations for future climate change predictions.
- Protect culture and heritage.

Given the building’s heritage nature, the proposed design initiatives must consider the impact of all works in respect of the Utzon Design Principles and Conservation Management Plan.

2.4 Minimise greenhouse gas emissions and provide low carbon energy resources

The list below sets out a number of key energy efficiency and low carbon initiatives to incorporate into the design.

- Apply the “10 steps to low energy” framework when developing the design to reduce energy consumption and carbon emissions.

Issue	Key points
1 Understand how energy is being used	Compare the performance against benchmarks, focus on operational energy not design ratings, identify the big energy uses and users and target these. Establish a metering and energy management plan. If you can't monitor it, you can't manage it.
2 Challenge design criteria	Consider whether alternative lighting and thermal comfort criteria can be adopted – task lighting approach and wider temperature bands.
3 Building fabric	Achieve an appropriate balance between daylight, views, heat loss and solar gain – is a fully glazed building the best solution? Provide good air tightness.
4 Ventilation	Can the windows be opened and a natural/mixed mode strategy be adopted? Mechanical systems should be designed to minimise fan power and running hours.
5 Heating and cooling	Design systems for efficient year-round operation and not just to meet peak demand. Zoning and controls are critical.
6 Lighting	Provide the right amount of light only where and when it's needed. Develop a lighting strategy using daylight, efficient fittings and controls.
7 Equipment	Purchase energy efficient servers, computers, monitors and appliances. Implement power management strategies and turn stuff off at night.
8 Other services	Saving water saves energy. Use efficient lifts and reduce unnecessary lift movement. Consider power factor correction.
9 Commissioning, handover and maintenance	Implement a commissioning plan and use the Soft Landings Framework. Incentivise the project team beyond handover. Proactive maintenance saves energy.
10 People	Engage with occupants and make it easy for them to save energy. Establish green teams and provide simple user guides.

Figure 1 10 Steps to Low Energy Guide.

(Source: *What Colour Is Your Building*, D H Clark, RIBA Publishing, 2013.)

- Implement Early Contractor Involvement (ECI) model to resolve the scope of works and risks issues during collaboration between the Client and Contractor. It enhances the construction

efficiencies for this uniquely challenging design development and provides opportunity to evaluate the cost and programme for the construction.

- Develop low energy internal lighting design to meet the minimum lux level.
- Upgrade existing or install new energy efficient light fittings such as LED.
- Upgrade existing lighting controls or install new control systems to reduce consumption and enhance flexibility. Motion or occupancy sensors and time clock controls should be installed where appropriate. Lighting control zones should be assigned carefully to allow maximum flexibility.
- Install or upgrade energy efficient equipment and motors.
- Install or upgrade existing equipment to be 30% more energy efficient than BCA standards (e.g. fans, pumps) as far as practical.
- Install simple equipment controls to enhance the ease of maintenance i.e. easily turned off when not needed.
- Install demand driven ventilation control to reduce fan, heating and cooling energy.

2.5 Reduce demolition, construction and operational waste

The following initiatives will minimise the demolition, construction and operational waste of the project:

- Implement Early Contractor Involvement (ECI) model to develop or discuss a fully integrated demolition waste management strategy. The following strategies should be discussed during collaboration:
 - Identify waste profile of the project and source appropriate waste processing facilities or contractors to divert waste from landfill;
 - Identify adequate spaces for material separation, storage and collection on site.
- Implement Sydney Opera House Asbestos Risk Management Plan (Hibbs & Associates Pty Ltd 2013) and the Sydney Opera House Hazardous Materials Action Plan (2015) for management and disposal of hazardous materials. Sydney Opera House will maintain a Hazardous Materials Register which documents all asbestos contaminated materials (ACM), hexavalent chromium and lead paints within the building.
- Removal and disposal of any hazardous materials will comply with all relevant laws, regulations and guidelines including, but not limited to, Protection of the Environment Operations Act 1997, Protection of the Environment Operations (Waste) Regulation 2014 and Protection of the Environment Operations (Illegal Waste Disposal) Act 2013.
- Demolition waste will be recycled or reused where possible with a target 60% to be diverted from landfill.
- Undertake an audit of existing materials and identify which materials can be reused or recycled.
- Reuse existing building materials or services whenever possible to reduce volume of demolition waste.
- Explore innovative ideas to reuse demolished materials such as precast pavers under the steps to reduce the volume of demolition waste.
- Construction waste will be recycled or reused where possible with a target 80% to be diverted from landfill.
- Include Green Star Construction Waste Management Plan requirements into the Contract. The following should be included as a minimum requirement:
 - Identify opportunities for waste minimisation in project planning stage, pre-construction stage, off-site activities stage and on-site activities stage.
 - Identify opportunities to minimise packaging waste from building materials, fittings and appliances. Avoid any unnecessary packaging.

- Demolition and construction waste reporting criteria for Waste Processing Facilities:
 - i. Operate legally with approved development approvals, and the relevant environmental licenses, etc.;
 - ii. Have auditable systems in place to prepare accurate reports on inbound and outbound waste;
 - iii. Undertake annual reporting of the independently verified gross diversion rates of waste from landfill, and the percentage of residual waste committed to landfill from their operations.
- Demolition and construction waste reporting criteria for Waste Contractors (transport and handlers):
 - I. Provide accurate reporting on waste collection and diversion from landfill;
 - II. Take all of a project's construction and demolition waste to waste processing facilities that meet the waste processing facilities criteria.

Further guidance on Green Star Construction and Demolition Waste Reporting Criteria can be found here: https://www.gbca.org.au/uploads/237/34797/C-D_Waste_Reporting%20Criteria_FINAL_210613.pdf

- Operational waste will be collected with a target 80% to be diverted from landfill.
- Provision of easily accessible waste sorting and recycling spaces within the project to divert waste from landfill.
- Provide adequate spaces for recycling bins where appropriate to suit SOH operational waste management plan. The following waste streams must be provided with separate bins or containers:
 - Food waste;
 - Cooking oil;
 - Paper and cardboard;
 - Glass;
 - Plastics;
 - General waste.
- Allow adequate spaces for food waste to be stored separately for collection by a composting company.
- Allow adequate spaces for cooking oil to be stored separately for collection by a biofuel manufacturer.

2.6 Reduce environmental impact from building materials

The following initiatives will reduce the environmental impact of the building materials of the project:

- Project team to consider materials for long design life (noting SOH was designed for 250 year life).
- Preference on products and equipment whose suppliers have a product stewardship program.
- Select materials that can be cleaned using SOH's current green cleaning techniques where feasible. The current green cleaning techniques apply to the following areas:
 - The use of olive oil to clean bronze fittings;
 - The use of baking soda and water to clean the concrete slabs;
 - The use of soap flakes and mud to clean the Utzon Room and Western Foyers' floor.
- Ensure appropriate and safe disposal of the demolished building materials which contain asbestos containing materials (ACM).
- Specify materials that are responsibly sourced or have a sustainable supply chain where possible.

- Specify low emissions materials such as engineered wood products, paints, adhesives, sealants and carpet to safeguard occupants' health and wellbeing.
- Specify steel that is sourced from a Responsible Steel Maker and is supplied by a steel fabricator or contractor accredited to the Environmental Sustainability Charter of the Australian Steel Institute (ASI) where new structural steel is required.
- Specify all timber to be either certified by a forest certification scheme such as Forest Stewardship Council (FSC) certification or from reused source where feasible. The timber must also comply with the SOH Renewal Materials Strategy.
- Specify products that contain polyvinyl chloride (PVC) to meet the requirements listed in the *Meet Best Practice Guidelines for PVC in the Built Environment*.
Further guidance on Best Practice Guidelines for PVC can be found here:
<https://www.gbca.org.au/files/literature-review-and-best-practice-guidelines-for-the-life-cycle-of-pvc-products>
- Select zero ozone depletion potential (ODP) and low global warming potential (GWP) refrigerants and zero ODP insulants.
- Incorporate the sustainable materials requirements into the Contract.

2.7 Reduce potable water consumption

The following water efficiency initiatives will drive the design to achieve a low potable water demand:

- Specify water efficient fittings and fixtures where new fittings are required.
- Consider the potential for rainwater collection and connection to recycled water reticulation pipework.

2.8 Support health and happiness

The following initiatives will support the health and happiness of staff and visitors:

- Implement strict health and safety standards.
- Seek opportunities to increase minimum outside air above Australian Standards (with CO₂ control where applicable).
- Improve acoustic comfort in spaces with adequate amount of sound absorbent materials and hard surfaces.
- Install internal blinds where required to improve the visual comfort of the building occupants.
- Improve thermal comfort through consideration of air temperature and air distribution.

2.9 Protect culture and heritage value

The following initiatives will protect the project's culture and heritage nature:

- Develop strategies to make sustainability visible and incorporate in to the learning curriculum.

2.10 Promote equity and local economy

The following initiatives will promote equity and local economy:

- Contractors to report on percentage (by cost) of labour and materials sourced within Sydney, NSW and Australia.
- Apply Social Return on Investment (SROI) principles to relevant initiatives.

2.11 Resilience and adaption to climate change

The project team will design systems with consideration for future climate change predictions (e.g. Office of Environment and Heritage (OEH) Metropolitan Sydney Climate Change Snapshot).

2.12 Sustainable environmental management

The following initiatives will encourage sustainable environmental management:

- Contractor to hold an Environmental Management System certified in accordance with ISO 14001.
- Contractor to develop a project specific Environmental Management Plan (EMP) for all demolition and construction works.
- Educate the Contractor and subcontractors to increase their knowledge on the benefits and outcomes of sustainable practices to expand the adoption of sustainable practices in the industry and deliver the desired sustainable outcome.

2.13 Innovation

All project works should be documented in Revit where feasible. All data on materials and equipment (operation, maintenance, cleaning, warranties, etc.) should be in electronic format for incorporation into the SOH building information modelling model (BIM).